

No. 738,326.

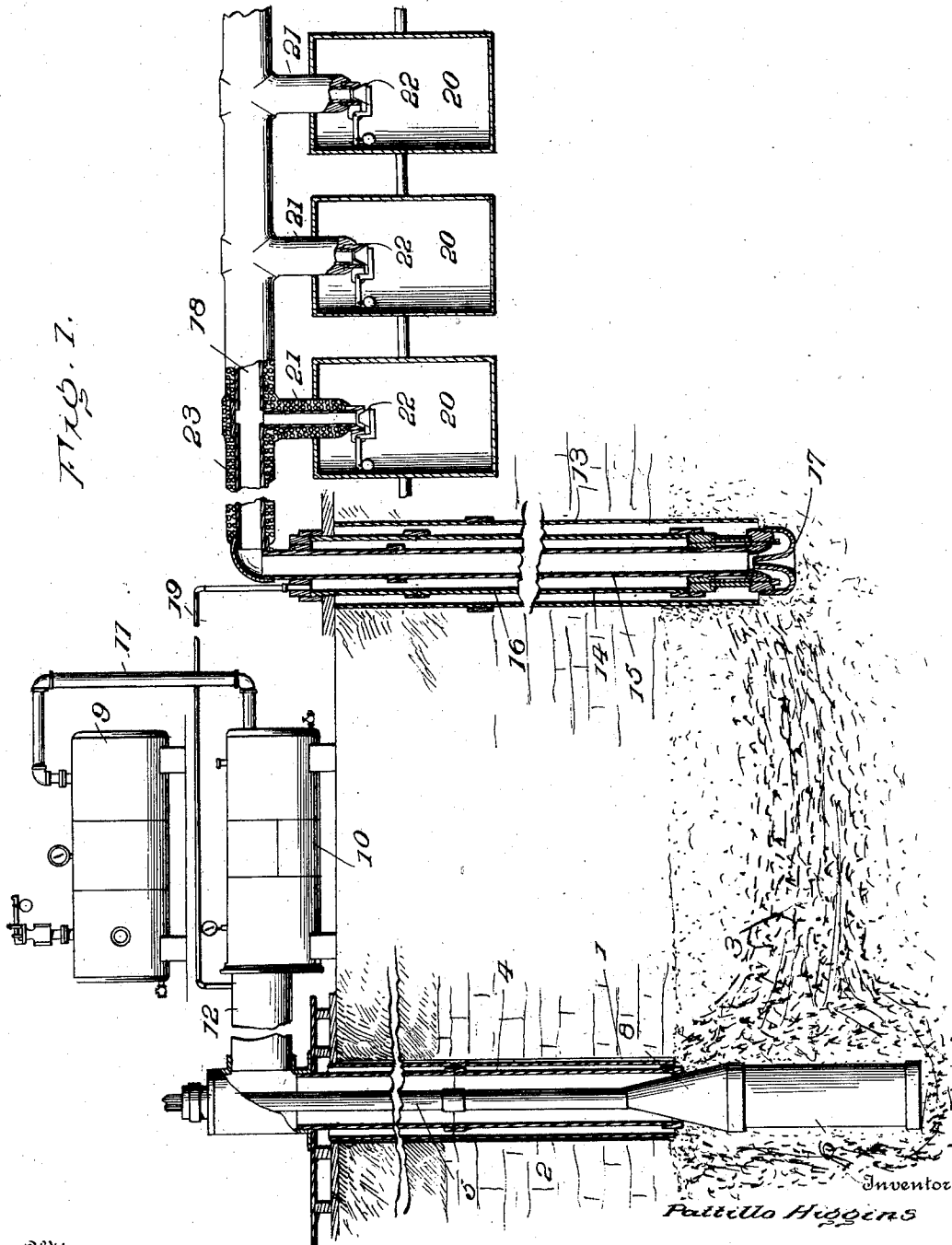
PATENTED SEPT. 8, 1903.

P. HIGGINS.
MINING SULFUR.

APPLICATION FILED DEC. 17, 1902.

NO MODEL.

2 SHEETS—SHEET 1.



Witnesses

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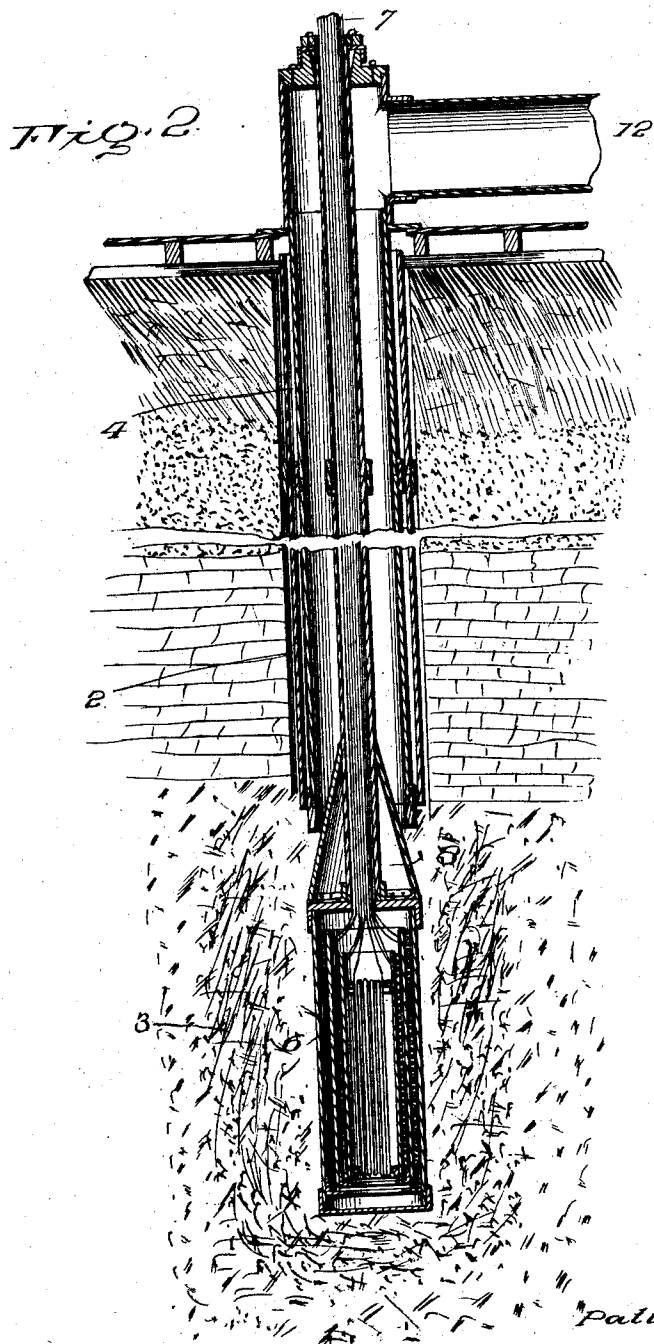
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2 SHEETS—SHEET 2.

NO MODEL.



Witnesses

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UNITED STATES PATENT OFFICE.

PATILLO HIGGINS, OF BEAUMONT, TEXAS.

MINING SULFUR.

SPECIFICATION forming part of Letters Patent No. 738,326, dated September 8, 1903.

Application filed December 17, 1902. Serial No. 135,571. (No model.)

To all whom it may concern:

Be it known that I, PATILLO HIGGINS, a citizen of the United States, residing at Beaumont, in the county of Jefferson and State of Texas, have invented certain new and useful Improvements in Mining Sulfur, of which the following is a specification.

This invention has relation to the extraction of sulfur from the stratum or bed bearing said mineral.

In mining sulfur in accordance with this invention an opening is bored into the earth, terminating in the mineral-bearing stratum, said opening being cased in a similar manner to deep wells. A fluid medium, such as air in a heated state, is forced into the mineral-bearing bed and penetrating the fissures and following the veins of mineral melt the same for a radius about the bore or opening, depending largely upon the character of the strata and the intensity of the heat. A mineral-raising device is located within the heating zone of the heater and is adapted to elevate the liquid mineral as quickly as melted from the strata. This elevator is kept heated and discharges the liquefied mineral into vats.

For a full description of the invention and the merits thereof and also to acquire a knowledge of the details of construction of the means for effecting the result reference is to be had to the following description and drawings hereto attached.

While the essential and characteristic features of the invention are susceptible of modification, still the preferred embodiment of the invention is illustrated in the accompanying drawings, in which—

Figure 1 is an elevation of an apparatus for mining sulfur constructed in accordance with the principles of this invention. Fig. 2 is a vertical central section of the preferred form of heater for liquefying the mineral in its bed or stratum.

Corresponding and like parts are referred to in the following description and indicated in both views of the drawings by the same reference characters.

This invention contemplates the formation of a well, the same extending to the bed or stratum containing the mineral to be mined. The well is indicated at 1 in the accompany-

ing drawings and is provided with a casing 2, the latter terminating about at the top or upper portion of the bed or stratum containing the sulfur or mineral to be obtained, so as not to obstruct the diffusion of the heat which melts the sulfur for a radius about the heater, as indicated at 3. A pipe 4 is passed through the casing 2 and is connected at its upper end with means for supplying a fluid medium, such as air heated to the required temperature for liquefying the mineral by contact therewith. A tube 5 is passed through the pipe 4 and is provided at its lower end with a suitably-incased electric heater 6 of any type of construction, said tube inclosing the wires 7, by means of which the electric current from a generator is conveyed to the coils comprising the heater. A tapering cap 8 is placed upon the upper end of the heater and around the tube and serves as a deflector for distributing the hot air as discharged into the bottom of the well through the pipe 4. The heater 6 is, in effect, a superheater to reheat or rather augment the temperature of the already heated air delivered to the bottom of the well from the pipe 4. It must be remembered that the air in its passage through the pipe 4 from the surface to the bottom of the well is in a measure cooled or loses an appreciable quantity of caloric, and the deficiency is compensated for by the heater 6, which insures delivery of the air into the fissures, veins, crevices, and the like of the mineral-bearing stratum at a temperature sufficient to insure melting of the sulfur or mineral with which it comes in contact.

Air under pressure may be supplied to the pipe 4 by any suitable means, and, as shown, an air-reservoir 9 is provided for containing compressed air, and this reservoir is connected with a heater 10, of any substantial construction, by means of a pipe 11, the air being raised to the required temperature in its passage through the heater 10 and passing into the pipe 4 through the lateral branch 12. The air in its passage through the heater is expanded. Hence the necessity for the increased capacity of the outlet-pipe 12 over the inlet-pipe 11. The element 10 may be an electric heater or used fuel of any kind, as may be found most economical.

Any contrivance or mechanism may be re-

sorted to for raising the liquefied mineral to the surface and discharging the same into vats or other desired receptacle. The mineral-raising apparatus must be located within the heating zone of the mineral-liquefier in order to elevate the mineral as reduced to a flowing state. The device for elevating the molten mineral must of necessity be arranged within a well near the well in which the liquefier is placed, this being shown in Fig. 1. The well for the elevator is provided with a casing 13 and receives the mineral-raising contrivance, consisting of concentric pipes 14 and 15, having the annular space 16 formed between them closed at its upper and lower ends, the pipe 15 being extended above and below the pipe 14 and provided at its lower end with a nozzle 17 and having its upper end communicating with a delivery-pipe 18. The pipe 15 is the discharge-pipe, and the liquefied mineral flows upwardly there-through into the delivery-pipe 18 and is kept in a flowing state by hot air filling the space 16, said hot air being supplied to the space 16 by means of a pipe 19 in communication with the pipe 12. One or more vats 20 are connected with the delivery-pipe 18 by branch pipes 21, the latter being provided at their lower ends with upwardly-closing valves 22. The delivery-pipe 18 and the branches 21 are kept heated to prevent solidifying of the mineral and are preferably incased and encircled by the electric heating-coils 23. Obviously the space between the pipes 18 and 21 and the casing may be supplied with hot air from the heater 10 in a manner similar to the space 16, the purpose being to keep the mineral in a liquid state until delivered into a vat or other receptacle.

In accordance with this invention hot air is supplied to the mineral-bearing stratum or bed by means of the pipe 4 and is superheated by the part 6, and, penetrating the strata, reduces the mineral for a radius about the heater 6 to a liquid state, as indicated at 3. After the mineral has been liquefied to the extent so as to reach the elevator the latter is set in operation and the molten mineral is raised to the surface and discharged into the vats or receptacles substantially in the manner stated. After the mining operation has begun the outflow of the mineral in a liquid state is continuous, the same being simultaneously reduced to a liquid state and elevated, there being no interruption, such as would be occasioned by operating the well intermittently, first by melting the sulfur and then replacing the liquefier by an elevator, and vice versa in alternation.

Having thus described the invention, what is claimed as new is—

1. The herein-described means for mining sulfur, the same comprising a liquefier introduced into a well leading into the mineral-bearing stratum, and a mineral-elevator located in a well within the heating zone of the liquefier, substantially as set forth. 65

2. In apparatus for mining sulfur, a heater for liquefying the mineral arranged in a well in communication with the mineral-bearing stratum, an elevator for the liquefied mineral located in a well within the zone of the afore-said heater, and means for supplying hot air to the heater and elevator, substantially as described. 70

3. In apparatus for mining sulfur, an incased superheater located at the bottom of the well in communication with the mineral-bearing stratum, a tube extended from said heater, and a conical deflector between the upper end of the incased heater and the carrying-tube, substantially as and for the purpose set forth. 75

4. In apparatus for mining sulfur, and in combination with means for elevating the liquefied sulfur, the same comprising a discharge-pipe, a delivery-pipe in communication with the discharge-pipe, a branch pendent from the delivery-pipe for discharging the mineral into a receptacle, and an upwardly-closing valve at the delivery end of said branch, substantially as specified. 80

5. In apparatus for mining sulfur, and in combination with the elevator for raising the liquefied mineral, said elevator comprising a discharge-pipe, a delivery-pipe in communication with said discharge-pipe, a series of branch pipes pendent from the delivery-pipe, a series of closed vats having the branch pipes extended therein, and upwardly-closing valves at the delivery ends of the branch pipes, substantially as described. 85

6. In combination, a pipe for conveying air under pressure to the mineral-bearing stratum, means for heating the air, a superheater at the bottom of the well, an elevator for raising the liquefied mineral located a distance from said superheater, means for supplying hot air to the elevator for keeping the mineral in a liquid state until discharged, a series of vats, and a series of discharge branches in communication with the delivery-pipe and provided with upwardly-closing valves extended into the respective vats, substantially as set forth. 90

In testimony whereof I affix my signature in presence of two witnesses. 95

PATTILLO HIGGINS. [L. s.] 100

Witnesses:

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GEORGE G. WATT. 105